



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
OSB2001-0029

April 6, 2001

Mr. Steven Calish
Eugene District Manager (Acting)
U.S. Bureau of Land Management
P.O. Box 10226
Eugene, Oregon 97440

Re: Endangered Species Act Formal Section 7 Consultation and Magnuson-Stevens Act
Essential Fish Habitat Consultation, Travis Tyrrell Seed Orchard Year 2001 Insecticide
Application, BLM Eugene District, South Valley Resource Area, Lane County, Oregon

Dear Mr. Calish:

Enclosed is a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act (ESA) for the Insecticide Application in 2001 at Travis Tyrrell Seed Orchard, Lane County, Oregon. NMFS concludes in this Opinion that the proposed action is not likely to jeopardize Oregon Coast coho salmon (*Oncorhynchus kisutch*), or destroy or adversely modify critical habitat. Pursuant to section 7 of the ESA, NMFS has included reasonable and prudent measures with non-discretionary terms and conditions that NMFS believes are necessary and appropriate to minimize the potential for incidental take associated with this project.

This Opinion also serves as consultation on Essential Fish Habitat pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and its implementing regulations (50 CFR Part 600).

Questions regarding this letter should be directed to Rob Markle of my staff in the Oregon State Branch Office at (503) 230-5419.

Sincerely,

Michael R. Crouse

Donna Darm
Acting Regional Administrator



Endangered Species Act Section 7 Consultation
Biological Opinion
and
Magnuson-Stevens Act
Essential Fish Habitat Consultation

Travis Tyrrell Seed Orchard's 2001 Insecticide Application
Lane County, Oregon

Agency: Bureau of Land Management, Eugene District

Consultation Conducted By: National Marine Fisheries Service,
Northwest Region

Date Issued: April 6, 2001

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1. BACKGROUND

The Bureau of Land Management (BLM) requested informal consultation with the National Marine Fisheries Service (NMFS) for Oregon Coast (CO) coho salmon (*Oncorhynchus kisutch*) on a proposed insecticide application for 2001 at the Travis Tyrrell Seed Orchard (Tyrrell Orchard) near Lorane, Oregon, in a letter received on March 7, 2001. A biological assessment (BA) for the proposed action was prepared and submitted electronically by the Eugene District BLM on March 2, 2001. A comprehensive monitoring plan was submitted to NMFS on March 13, 2001. At NMFS' request, BLM provided a sublethal effects risk assessment on March 14, 2001. On March 28, the BLM provided a revised risk assessment in accordance with an U. S. Environment Protection Agency (EPA) document, which indicated the original method used (quotient method) was not the accepted standard for endangered species (EPA 1986). After reviewing the biological assessment and supporting documents, and considering the sensitive nature of the subject action, NMFS decided that formal consultation was warranted. This biological opinion (Opinion) was prepared in response.

The BLM proposes to apply an insecticide to control Douglas-fir gallmidge (*Contarinia oregonensis*) and Douglas-fir seed chalcid (*Megastigmas spermatrophus*) at the Tyrrell Orchard. Asana®XL (Asana) or Digon 400® (Digon) would be applied to selected cone-bearing trees. The purpose of the action is to control cone insects which cause damage and seed loss to orchard cone crops. The proposed action is in conformance with the Eugene District Record of Decision and Resource Management Plan (RMP) (BLM 1995). BLM has stated that the Tyrrell Orchard has been administratively withdrawn, and therefore is not required to meet the aquatic conservation strategy (ACS) objectives presented in Appendix A of the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (Northwest Forest Plan) (USFS/BLM 1994). The 832.5 acre orchard is located three miles west of Lorane, Oregon. The subject action would occur in two unnamed tributary drainages within the Siuslaw River Basin, a perennial tributary of Douglas Creek (Stream 12) and a perennial tributary (Stream 8) of the Siuslaw River. Douglas Creek enters the Siuslaw River at approximately river mile 106.5 and Stream 8 enters the Siuslaw River at river mile 107.

Prior to requesting consultation, a conditional effect determination was made by the Eugene District Fisheries Level 1 Team (Team) on January 17, 2001. The Team followed procedures described in NMFS 1996, and determined that the insecticide application was not likely adversely affect OC coho salmon, nor likely to adversely modify OC coho salmon critical habitat if drift and contaminated organics/soils could be prevented from reaching perennial waterways. Though an alternative chemical was mentioned, agreement was solely for an Asana application. The Team made a site visit to the Horning Seed Orchard (another BLM seed orchard) on February 5, 2001, and NMFS completed a site visit to the Tyrrell Orchard on February 14, 2001, to more completely evaluate site conditions.

Manual treatments to reduce insect damage have been attempted for the past three years. In spite of this effort, seed extraction completed in 1999 and 2000 showed a considerable reduction in yield due to insect problems. Preliminary reports indicate the estimated loss from insect-related damage was approximately 34% in 2000. In 2001, non-chemical methods of insect control were considered, including pheromone gallmidge traps. However, while the Tyrrell Orchard is currently working with Simon Fraser University to field test these pheromone traps, the effectiveness of these traps and other alternative methods are unproven at this time. If insecticide is not used, loss estimates for 2001 indicate 40 to 50% of the seed crop will be lost to insect damage.

This Opinion considers the potential effects of the proposed action on OC coho salmon, which occur in the proposed project area. OC coho salmon were listed as threatened under the Endangered Species Act (ESA) on August 10, 1998 (63 FR 42587), critical habitat was designated on February 16, 2000 (65 FR 7764) and protective regulations were issued on July 10, 2000 (65 FR 42422). The objective of this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of OC coho salmon, or destroy or adversely modify designated critical habitat for this species. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 CFR 402, and the Magnuson-Stevens Act section 305(b) and its implementing regulations, 50 CFR 600.

2. PROPOSED ACTION

In spring 2001, BLM proposes to apply the insecticide Asana (active ingredient is esfenvalerate) or Digon (active ingredient is dimethoate) in five units (Lorane, McKenzie Low, Swisshome/Mapleton, Wells Creek, and Noti) totaling 42 acres. The decision on which insecticide to use will be based on the weather conditions, planning efforts and the projected environmental affects. Asana must be applied in mid to late April for maximum effectiveness. If circumstances prevent esfenvalerate application from occurring in April, dimethoate is proposed.

2.1. Asana Application

Asana would be applied in one application with timing dependent on the target insect and the time of emergence. Traps would be set to determine the timing of emergence and level of infestation of Douglas-fir cone gallmidge and the Douglas-fir seed chalcid. Hydraulic sprayers fitted with hand held trigger nozzles will be utilized. Ground application allows treatment of only cone-bearing trees to occur. Approximately 1,235 trees are proposed for treatment. Ground application will allow effective treatment to occur using 5 to 10 times less insecticide than comparable aerial application methods (varies by orchard unit). Table 1 indicates the rate of esfenvalerate application proposed for each of the five orchard units.

Table 1. Asana application is proposed for a minority of the stock within each unit and ground-based application methods will allow a low application rate to be used.

Orchard Unit	Trt. Area (Acres)	Total Trees in Trt. Area (#)	Potential Cone Bearing Trees (#)	Potential Cone Bearing Trees (%)	Treated Trees/Acre (#)	Esfenvalerate	
						Rate per Tree (lb. of a.i.*)	Rate per Acre (lb. of a.i.*)
McKenzie Low	9	978	160	16%	18	0.001	0.018
Swisshome/Mapleton	12	1347	450	33%	38	0.001	0.038
Lorane	4	458	110	24%	28	0.001	0.028
Wells Creek	7	763	190	25%	27	0.001	0.027
Noti	10	1200	325	27%	33	0.001	0.033

* a.i. = active ingredient

The spray units will likely be truck mounted, but could include a 4-wheeler spray unit for the smaller trees (Lorane and McKenzie Low orchards). The hydraulic sprayers will utilize a 3.0 to 3.5 mm nozzle. As nozzle sizes become smaller in size, they create an increasingly finer mist and greater chance for drift, while those larger than 3.5 mm might be too heavy to adequately reach the upper portions of the trees. Testing with various nozzle tips will be necessary at the start of the spray operation to determine the optimum nozzle size and pressure to both adequately spray the cone crop and minimize the chances for atomization and drift. Water is the carrier agent, and no surfactants or other additives will be used (G. Miller, BLM, personal communication via telephone, March 30, 2001).

BLM has proposed the following conservation measures to minimize the threat of waterway contamination and downstream affects on OC coho salmon.

- 1) All applicable local, state and Federal laws, including the EPA insecticide labeling instructions, will be strictly followed. Insecticides will be applied within the prescribed environmental conditions stated on the label.
- 2) Insecticide application will occur in the early morning when wind, temperature and humidity are optimum for minimizing drift. Spraying will be limited to periods when wind speeds are less than 6 mph, temperature is less than 70 °F, and relative humidity is greater than 50%. Application will not occur in periods of wind turbulence, when

precipitation or fog is occurring or is imminent, during inversions, or when foliage is carrying snow or ice. Environmentally sensitive unit margins will be sprayed preferentially at first light when winds are typically calm (G. Miller, BLM, personal communication with R. Markle, February 14, 2001). Applications will be timed so as not to coincide with or closely precede large storm events that could result in substantial runoff. If the long term forecast (1 to 3 day) predicts a storm with heavy precipitation, spraying will not be done. In addition, spraying will be timed to precede at least 12 hours of dry weather, which will be an adequate amount of time for the spray application to dry.

- 3) When spraying trees within two tree rows from the edge of treatment unit perimeters, spraying will be done by directing the nozzle towards the center of the treatment unit, minimizing the chance for drift outside the designated treatment areas.
- 4) Precautions will be taken to assure that equipment used for transport, mixing, and application will not leak insecticides into water or soil. Ridge-top staging areas used for mixing insecticides and cleaning equipment will be located at least 200 feet from streams. A spill kit filled with absorbent materials will be located near the mixing area in the unlikely event of an emergency. An emergency safety plan will be developed. NMFS will be notified in the unlikely event of a chemical spill.
- 5) If possible, mowing will take place 2 to 3 days prior to spraying to remove any floral component that may attract pollinators, such as bees, into the treatment area. Weather conditions, stage of vegetative growth, and operational limitations could affect the timing of this conservation measure.
- 6) To minimize impacts to non-target insects, such as pollinators, spray operations will be done, if possible, during periods when temperatures are less than 56° F. When temperatures are cooler insects are less active.
- 7) A 200-foot no-spray buffer will be maintained on all perennial and intermittent streams, or any surface water present at the time of application regardless of its designation (N. Armantrout, BLM, personal communication to the Team, January 17, 2001) (Table 2).
- 8) Silt fence catchment barriers will be installed across all ephemeral drainages located adjacent to or inside treatment units (Table 2). The function of these barriers will be to catch organics and sediment (and adsorbed insecticide) leaving the treatment area.
- 9) Sand traps will be placed immediately above silt fence catchment barriers to enhance retention of transported organics and sediments, and to provide a potential sample medium for monitoring efforts (G. Miller, BLM, personal communication via telephone with R. Markle, March 6, 2001).

- 10) Soil aeration will be done along unit boundaries downslope from treatment units and above catchment barriers (Table 2). This will increase infiltration, reduce over-ground flow, and maximize binding of insecticide by soils. Soil aeration is periodically done in all orchards to reduce compaction and promote water and nutrient infiltration into the soil. At Tyrrell Orchard, aeration was last done in the fall, 2000. Unlike the Horning Seed Orchard, cattle do not graze the Tyrrell Orchard.
- 11) Spray detection cards will be placed outside treatment unit boundaries to monitor for drift (Table 2). These cards will be spaced 100 feet apart and will be stapled at a 45° angle to the top of fence posts or wooden lathe, with the cards facing the treatment area. Spray cards will be placed at varying distances from 35 to 100 feet from the treatment areas to determine drift distances. Spray cards will be checked concurrently with spray operations when spraying occurs within 100 feet of the spray cards. Application techniques will be altered or spray operations halted if drift is detected 60 feet from the treatment area or outside the aeration perimeter (G. Miller, BLM, personal communication via telephone with R. Markle, March 12, 2001). It is anticipated when operating within the interior of the treatment units and according to the spray guidelines (wind, temperature, and humidity) that the chances of drift occurring outside the treatment areas will be negligible.

Table 2. Insecticide application will incorporate site specific containment measures designed to minimize off-site transport of insecticide and contamination of perennial and intermittent waterways.

Orchard Unit	Boundary/Description	Buffers	Drift Cards	Catchment barriers/ Aeration
McKenzie Low (trees 10' tall)	west-road, fenceline, timber	not needed, upslope	not needed	not needed
	north-fallow ground	not needed, upslope	not needed	not needed
	east-adjacent unit (10' tall trees)	not needed, no perennial or intermittent streams	not needed	barrier on ephemeral channel #19 and aeration above barrier and along entire boundary
	south-adjacent unit (small trees)	not needed, 200' from intermittent stream #12	yes	Aeration along entire boundary

Orchard Unit	Boundary/Description	Buffers	Drift Cards	Catchment barriers/ Aeration
Swisshome/ Mapleton (trees 20-30' tall)	west-private	not needed, upslope	not needed	not needed
	north-fallow ground	not needed, upslope	not needed	not needed
	east-untreated portion of unit (20-30' tall trees) and thick vegetative cover	not needed, 200- 600' from stream #8)	not needed	barrier on ephemeral channel #52, Aeration along entire boundary
	south-fenceline, road, timber	200' buffer on ephemeral stream #51 (if live water)	yes-along southwest portion near stream #51	barrier on stream #51 (put next to fence), Aeration above barrier and along entire boundary
Lorane (trees 15-20' tall)	west-road and thick vegetative cover	not needed-300' from stream #8	not needed	barrier on channel at SW corner of unit, Aeration above barrier
	north-fallow ground	not needed, upslope	not needed	not needed
	east -untreated portion of unit (15-20' tall trees)	not needed, 400' from intermittent stream #54	not needed	not needed
	south-fallow ground	not needed	not needed	not needed
Wells Creek (trees 20-30' tall)	west-private	not needed	not needed	not needed
	north-fallow ground	200' buffer from intermittent stream #9 in NE corner of unit	yes-along buffer of stream #9	Aeration along boundary next to buffer
	east- thick vegetative cover 100' to stream #8	200' buffer from perennial stream #8	yes	Aeration along entire boundary
	south-fallow ground	200' buffer from live water in stream #5	yes -east portion of unit boundary	barrier on ephemeral channels #5 & 7, Aeration along entire unit boundary

Orchard Unit	Boundary/Description	Buffers	Drift Cards	Catchment barriers/ Aeration
Noti (trees 20-30' tall)	west-thick vegetative cover	not needed, 300' from stream #8	yes	Aeration along entire boundary
	north-fallow ground	not needed, upslope	not needed	not needed
	east-private	not needed, upslope	not needed	not needed
	south-fenceline, road, young timber	>200' buffer from ephemeral /intermittent stream #54	yes	Aeration along entire boundary

A water quality monitoring plan (Appendix A) has been proposed. The plan objectives are to ensure compliance, evaluate effectiveness, and establish validation that project implementation adequately avoids and minimizes waterway and associated coho salmon habitat contamination. The compliance monitoring is intended to document the design features and conservation measures that are implemented. The effectiveness monitoring will document how well the design features performed in avoiding introduction of insecticide to the aquatic system. The effectiveness data will also be used to validate the water quality modeling.

2.2. Digion Application

As an alternative to Asana, Digion (dimethoate) may be used to treat affected trees. As with esfenvalerate, dimethoate application is proposed for a minority of the stock within each unit and ground-based application methods will allow a low application rate to be used (Table 3). A single dimethoate application will take place in April to early June, depending on time of insect emergence and weather conditions, to suppress the cone gallmidge and seed chalcid. All other application methods will be the same as described for esfenvalerate.

Table 3. Dimethoate application is proposed for a minority of the stock within each unit and ground-based application methods will allow a low application rate to be used.

Orchard Unit	Trt. Area (Acres)	Total Trees in Trt. Area (#)	Potential Cone Bearing Trees (#)	Potential Cone Bearing Trees (%)	Treated Trees/Acre (#)	Dimethoate	
						Rate per Tree (lb. of a.i.*)	Rate per Acre (lb. of a.i.*)
McKenzie Low	9	978	160	16%	18	0.028	0.504
Swisshome/Mapleton	12	1347	450	33%	38	0.028	1.064
Lorane	4	458	110	24%	28	0.028	0.784
Wells Creek	7	763	190	25%	27	0.028	0.756
Noti	10	1200	325	27%	33	0.028	0.924

* a.i. = active ingredient

3. BIOLOGICAL INFORMATION AND CRITICAL HABITAT

Although there are currently limited data to assess population numbers or trends, NMFS believes that all coho salmon stocks comprising the OC coho salmon Evolutionary Significant Unit (ESU) are depressed relative to past abundance. The status and relevant biological information concerning OC coho salmon are well described in the proposed and final rules from the Federal Register (July 25, 1995, 60 FR 38011; and May 6, 1997, 62 FR 24588, respectively), and Weitkamp *et al.* (1995).

Abundance of wild coho salmon spawners in Oregon coastal streams declined during the period from about 1965 to roughly 1975 and has fluctuated at a low level since that time (Nickelson *et al.* 1992). Spawning escapements for this ESU may be at less than 5% of abundance from that in the early 1900s. Contemporary production of coho salmon may be less than 10% of the historic production (Nickelson *et al.* 1992). Average spawner abundance has been relatively constant since the late 1970s, but preharvest abundance has declined. Average recruits-per-spawner may also be declining. The OC coho salmon ESU, although not at immediate danger of extinction, may become endangered in the future if present trends continue (Weitkamp *et al.* 1995).

Timing of adult coho salmon river entry is largely influenced by river flow. Coho salmon normally wait for freshets before entering rivers. In the Siuslaw River watershed, adults are believed to typically enter the river between September and mid-January (Tami Wagner, ODFW, personal communication via telephone with R. Markle, February 6, 2001) with peak migration into the Siuslaw River occurring in October (Mullen 1981, as cited in Weitkamp *et al.* 1995). Spawning occurs from late October to late January with peak spawning generally occurring in mid-December (Weitkamp *et al.* 1995). Seaward migration of juveniles occurs during spring. Reports of outmigration timing vary from February through June (Rodgers *et al.* 1993, as cited in Weitkamp *et al.* 1995) to March into early July (Tami Wagner, ODFW, personal communication via telephone with R. Markle, February 6, 2001).

Coho salmon are found approximately 3,000 feet below the McKenzie Low unit at the Stream 12 and Douglas Creek confluence, and almost 5,280 feet downstream of the other treatment units in the Stream 8 drainage that flows through Section 15. Cutthroat trout, sculpin, steelhead, lamprey, suckers, redbreasted shiners and dace are found in Douglas Creek. Cutthroat trout and sculpin are also found in Douglas Creek tributaries. Though their presence is unconfirmed, chinook salmon (*Oncorhynchus tshawytscha*) have been reported in the Siuslaw River near the mouth of Douglas Creek. Crayfish and giant Pacific salamanders have been found in both creeks.

Critical habitat for OC coho salmon includes Oregon coastal river basins (freshwater and estuarine areas) between Cape Blanco and the Columbia River. Freshwater critical habitat includes all waterways, substrates, and adjacent riparian areas—areas adjacent to a stream that provides the following functions: Shade, sediment, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter—below longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and several dams that block access to former coho salmon habitat. The proposed action would not occur in designated critical habitat for OC coho salmon.

4. EVALUATING PROPOSED ACTION

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR Part 402 (the consultation regulations). In conducting analyses of habitat-altering actions under section 7 of the ESA, NMFS uses the following steps: (1) Consider the status and biological requirements of the species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species; (4) consider cumulative effects; and (5) determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild or adversely modify its critical habitat. In completing this step of the analysis, NMFS determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the continued existence of the listed species, and/or result in destruction or adverse modification of

their critical habitat. If NMFS finds that the action is likely to jeopardize the listed species, NMFS must identify reasonable and prudent alternatives for the action.

4.1. Biological Requirements

The first step in the method NMFS uses for applying the ESA section 7(a)(2) to listed salmon is to define the biological requirements of the species most relevant to each consultation. NMFS also considers the current status of the listed species by taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NMFS starts with the determinations made in its decision to list OC coho salmon for ESA protection and also considers new data available that are relevant to the determination (Weitkamp *et al.* 1995).

The relevant biological requirements are those necessary for OC coho salmon to survive and recover to naturally reproducing population levels at which protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, the biological requirements are habitat characteristics that function to support successful spawning, rearing and migration. The current status of the OC coho salmon, based upon their risk of extinction, has not significantly improved since the species was listed and, in some cases, their status may have worsened.

4.2. Environmental Baseline

The environmental baseline is an analysis of the effects of past and on-going human and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined as all areas (bankline, adjacent riparian zone, and aquatic area) to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). Direct effects occur at the project site and may extend upstream or downstream based on the potential for impairing fish passage, hydraulics, sediment and pollutant discharge, and the extent of riparian habitat modifications. Indirect affects may occur throughout the watershed where actions described in this Opinion lead to additional activities or affect ecological functions contributing to stream degradation. For this consultation, the action area includes the treatment units and all hydrologically connected waterways downstream to the Siuslaw River.

The bulk of production for the OC coho salmon ESU is skewed to its southern portion where the coastal lake systems (e.g. Tenmile, Tahkenitch, and Siltcoos basins) and the Coos and Coquille Rivers are more productive. Though the proposed action area is located between the Tenmile and Siltcoos basins, the OC coho salmon population is depressed and the habitat in the action area is underseeded. Coho salmon typically spawn in the streams associated with the Tyrrell

Orchard in December and fry would be expected to emerge prior to or about the time of the proposed insecticide application, depending on water temperatures. In 2000/2001, reduced precipitation delayed spawning, and redd counts suggest coho salmon spawned much further down in the Siuslaw River basin due to low flows. However, prior year classes of juvenile coho salmon can be expected to be rearing within the action area.

The Tyrrell Orchard was established in 1983 as a centralized tree seed orchard designed to provide genetically improved Douglas-fir seed for BLM's Coos Bay, Roseburg and Eugene Districts. The seed produced is genetically diverse and is well adapted for reforesting sites in western Oregon. In 1998, a cooperative agreement was initiated with ten private timber and seed companies. The orchard has 24 Douglas-fir seed production units. These units range in age from six to thirteen years and have measurable cone production beginning at about age nine. Since the oldest orchard units have just started to produce cone crops in the past several years, the demand for seed from the Tyrrell Orchard is very high. The ground within the orchard is thoroughly covered with vigorous grasses.

The Douglas Creek watershed is 2,965 acres and the Stream 8 watershed is 494 acres. Forestry is the predominate land use within the Upper Siuslaw River watershed. Winters are typified as mild and wet, while summers are cool and relatively dry.

The Siuslaw River is on the Oregon Department of Environmental Quality (ODEQ) 303(d) List of Water Quality Limited Water Bodies for temperature. The temperature standard (64 °F) is regularly exceeded (63%) during summer flows from the mouth to the headwaters. Historic readings at Mapleton indicate temperature exceedences occurred in 1980, 1982, and 1984 to 1992 with a maximum of 75.2 °F.

5. ANALYSIS OF EFFECTS

5.1 Effects of Proposed Action

The effects of chemical insecticide use frequently extend beyond the intended target species. Insecticide composition (including inert ingredients, carrier agents, and surfactants), chemical character, environmental conditions, and application techniques are among the parameters that determine the degree to which insecticide effects will impact non-target species and their ecosystems. Scientific studies have documented lethal effects, and to a lesser degree sublethal effects, of active ingredients on many species. These studies are typically laboratory derived and findings may vary greatly. For example, pyrethroid LC₅₀ concentrations for salmonids have been shown to vary considerably (Table 4). Field conditions may provide some ameliorating circumstances that may reduce exhibited chemical toxicity. Smith and Stratton (1986) state, "field applications usually have no pronounced effects on *in situ* fish survival." Furthermore, inert ingredient toxicity is frequently overlooked and is often little studied or understood. However, the myriad of possible chemical/species interactions frequently necessitate that

chemical classes and/or species groups must be used as the best available science to anticipate potential effects on a particular species.

Similarly, there is currently a question of the adequacy of using LC₅₀ values to predict *take* in the context of the ESA. Scholz *et al.* (2000) state in their paper on diazinon that conventional toxicity studies, including the LC₅₀ experimental paradigm, may underestimate neurobehavioral thresholds for fish. Little *et al.* (1990) noted behavioral changes in rainbow trout at chlordane (organochlorine insecticide) concentrations below EPA's not-to-be-exceeded concentration illustrating the inadequacy of using current EPA application guidelines for avoiding sublethal effects.

Table 4. Smith and Stratton (1986) indicate lethal effect concentrations for pyrethroid insecticides on salmonids vary considerably.

Coho Salmon

- 96 hr LC₅₀ = 22.2 µg/L allethrin (Mauck *et al.* 1976).

Rainbow Trout

- 24 hr LC₅₀ = 3.8 µg/L fenvalerate (Mulla *et al.* 1978).
- 24 hr LC₅₀ = 4.7 µg/L fenvalerate (Holcombe *et al.* 1982).
- 24 hr LC₅₀ = 76 µg/L fenvalerate (Coats and O'Donnell-Jeffrey 1979).
- 48 hr LC₅₀ = 3.0 µg/L fenvalerate (Mulla *et al.* 1978).
- 96 hr LC₅₀ = 0.32 µg/L flucythrinate (Worthing and Walker 1983).
- 96 hr LC₅₀ = 2.1 µg/L fenvalerate (Holcombe *et al.* 1982).
- 96 hr LC₅₀ = 17.5 µg/L allethrin (Mauck *et al.* 1976).

Atlantic Salmon

- lethal threshold = 0.46 µg/L fenvalerate (McLeese *et al.* 1980).
- 96 hr LC₅₀ = 1.2 µg/L fenvalerate (McLeese *et al.* 1980).

5.1.1. Asana

Asana is comprised of esfenvalerate (8.4%) and inert ingredients (91.6%), including two potentially toxic substances that have a high priority with the EPA for testing: xylene (<3%) and ethylbenzene (<1%). Esfenvalerate is a synthetic pyrethroid insecticide and is registered as a moderately toxic insecticide for use for forestry, range, conifer seed orchards, forest tree nurseries, and right-of-way pest control. Esfenvalerate is a sodium channel blocker that kills insects on contact or ingestion. Non-target insects may similarly be effected.

Pyrethroids, including esfenvalerate, are highly toxic to aquatic invertebrates and fish (Moore and Waring 2001, Tanner and Knuth 1996, Little *et al.* 1993, Eisler 1992, Smith and Stratton 1986, Curtis *et al.* 1985). Eisler (1992) states that though few environmental problems to

aquatic organisms have been documented from the use of synthetic pyrethroid insecticides, extreme caution is warranted when used within endangered species habitats. Fenvalerate LC_{50} concentrations for mayflies range from 0.07-0.93 $\mu\text{g/L}$ and for stoneflies is 0.13 $\mu\text{g/L}$ (Smith and Stratton 1986). NMFS was unable to locate an esfenvalerate LC_{50} concentration for coho salmon, however, approximately 40% of the pyrethroid LC_{50} values for fish are $\leq 1.0 \mu\text{g/L}$ (Smith and Stratton 1986). The esfenvalerate 96-hour LC_{50} concentration for rainbow trout (*Oncorhynchus mykiss*) is 0.3 $\mu\text{g/L}$ (Exttoxnet website at <<http://ace.orst.edu/cgi-bin/mfs/01/pips>>). Curtis *et al.* (1986) found a 96-hour fenvalerate LC_{50} concentration for alevin rainbow trout of 0.088 $\mu\text{g/L}$.

Sublethal effects in fish have been documented at recommended rates of application (Smith and Stratton 1986). As stated in Smith and Stratton (1986); “Pyrethroids are lipophilic and are likely to be strongly absorbed by the gills, even from water containing very low pesticide concentrations.” While little is known regarding the sublethal effects of esfenvalerate on coho salmon in particular, a recent study of a synthetic pyrethroid insecticide on Atlantic salmon (*Salmo salar*) found male parr exhibited an inhibited olfactory response following a five day exposure to concentrations of less than 0.004 $\mu\text{g/L}$ or 4 parts per trillion (Moore and Waring 2001). The same study found exposure of milt and eggs to a concentration of 0.1 $\mu\text{g/L}$ reduced egg fertilization. Bluegill (*Lepomis macrochirus*) exposed to pulses of low esfenvalerate concentrations (0.025 $\mu\text{g/L}$) exhibited behavioral responses including gross body tremors within 4 hours (Little *et al.* 1993). Esfenvalerate may bioaccumulate in the tissues of fish and other aquatic organisms, but is not known to biomagnify. Smith and Stratton (1986) state that synthetic pyrethroid insecticides are rapidly eliminated from tissue after discontinuation of exposure and are not expected to biomagnify through the food chain.

The persistence of esfenvalerate varies upon environmental conditions with half-lives in direct sunlight, soil, and water being 7.5 days, up to 90 days, and 10 to 220 days, respectively. At least one study found pyrethroids to be “relatively non-persistent and do not accumulate in the environment” (Smith and Stratton 1986). Chapman *et al.* (1981) applied 1 part per million of the pyrethroid fenvalerate to mineral and organic soils. Eight weeks after application, 12% of the applied fenvalerate remained in the mineral soil sample, and 58% remained in the organic soil sample. Another study that applied Asana (esfenvalerate) in two applications 30 days apart directly to littoral enclosures found maximum water concentrations within 1 to 3 hours after application and only 10% remained after 24 hours (Heinis and Knuth 1992). Esfenvalerate concentrations were undetectable (0.047 $\mu\text{g/L}$) in water within 4 days. And yet, the same littoral enclosure study found: “Water and sediment, and, to a lesser extent, aquatic vegetation and macrophytes, were important reservoirs for esfenvalerate” (Heinis and Knuth 1992). In general, soil organisms and photodegradation breakdown esfenvalerate in the environment producing carbon dioxide, acid, and alcohol. Some breakdown products may be more toxic than the active ingredient. Esfenvalerate readily binds to organic matter in the soil, has little mobility, and is practically insoluble in water. The potential for leaching into groundwater is very low.

The inert Asana ingredient xylene very quickly evaporates into the air from surface water and soil where it may remain for several days until it is broken down by sunlight. Because xylene is applied as a liquid, it does have the potential to infiltrate into the soil. Most xylene in surface water evaporates into the air in less than a day. Xylene is more persistent in groundwater where evaporation is impaired.

The inert Asana ingredient ethylbenzene is most commonly found in vapor form since it moves easily into the air from water and soil. In the air, ethylbenzene is broken down by sunlight in approximately 3 days. In surface water, it breaks down by reacting with other compounds. In soils, ethylbenzene is broken down by bacteria.

5.1.2. Digion

Digion is an organophosphate insecticide registered for use on fruits, nuts, vegetable crops, field crops, seed crops, ornamental tree uses, and trees. Digion is comprised of dimethoate (43.5%) and inert ingredients (56.5%), including petroleum distillate (8.5%) and cyclohexanone (35.0%). A neurotoxin, dimethoate is an acetylcholinesterase inhibitor. Dimethoate is of low persistence in the soil.

Dimethoate is highly toxic to aquatic invertebrates (i.e., stoneflies) and moderately toxic to fish. According to an EPA statement on dimethoate, “acute risks to aquatic invertebrates resulting from surface run-off to rivers and streams is high, based on study results” (EPA website - <<http://www.epa.gov/pesticides/op/dimethoate/dimethsumm.htm>>).

The following information was taken from the Exttoxnet website at <<http://ace.orst.edu/cgi-bin/mfs/01/pips>>. Soil half-lives range from 4 days to as high as 122 days, but a representative value of 20 days is accepted. Highly soluble in water, dimethoate adsorbs very weakly to soil particles. Because of these characteristics, considerable dimethoate leaching may occur. However, it is degraded by hydrolysis, especially in alkaline soils, and evaporates from dry soil surfaces. Losses due to evaporation of 23 to 40% of applied dimethoate have been reported. Significant biodegradation may occur, with losses of 77% reported in clay loam soil after 2 weeks. In water, dimethoate does not adsorb to sediments or suspended particles, and bioaccumulation in aquatic organisms is not likely. It is subject to significant hydrolysis, especially in alkaline waters. The half-life for dimethoate in rivers is 8 days, with disappearance possibly due to microbial action or chemical degradation. Photolysis and evaporation from open waters are not expected to be significant.

Dimethoate is moderately toxic to fish, with reported LC_{50} values of 6.2 mg/L for rainbow trout (Exttoxnet website at <<http://ace.orst.edu/cgi-bin/mfs/01/pips>>). Several recent studies of cholinesterase inhibitors (organophosphates or carbamates) have documented sublethal effects on chinook salmon (Scholz *et al.* 2000), rainbow trout (Brewer *et al.* 2001; Beauvais *et al.* 2000; Little *et al.* 1990), and Atlantic salmon (Waring & Moore 1997; Moore & Waring 1996). Sublethal effects included alteration of olfactory function, swimming behavior, swimming

capacity, feeding behavior, and vulnerability to predation. Responses varied depending on exposure concentrations and the particular organophosphate or carbamate applied. Following short-term exposures, chinook salmon were found to experience inhibited olfactory alarm responses at concentrations of 1.0 mu g/L, and homing impairment at 10 mu g/L (Scholz *et al.* 2000). Such responses may increase predation mortalities and increase straying. Other studies found similar sublethal effects at 1.0 mu g/L for diazinon (organophosphate) and carbofuran (carbamates), both cholinesterase inhibitors (Waring & Moore 1997; Moore & Waring 1996) (Table 5). Moore and Waring (1996) found that Atlantic salmon parr exposed to a 1.0 mu g/L diazinon concentration for 30 minutes took 4.5 hours to recover in clean water.

Table 5. The available literature indicates sublethal effect concentrations for cholinesterase inhibiting insecticides (organophosphate and carbamates) are as low as 1.0 mu g/L.

Scholz *et al.* 2000.

- 1.0 mu g/L diazinon = inhibited olfactory-mediated responses.
- 10.0 mu g/L diazinon = homing behavior impaired (preliminary finding, small sample size).

Waring and Moore 1997.

- 1.0 mu g/L carbofuran = significantly reduced responses to prostaglandin.
- 2.7 mu g/L carbofuran = abolished priming effect of prostaglandin on milt and plasma 17,20 β .
- > 6.5 mu g/L carbofuran = abolished priming effect of prostaglandin on plasma testosterone and 11-ketotestosterone.

Moore and Waring 1996.

- 30 min exposure @ 1.0 mu g/L diazinon = significantly affected olfactory mediated detection of prostaglandin.
- Longer exposure @ 1.0 mu g/L diazinon = suppressed plasma levels of steroids and gonadotrophin II (GtH-II).
- 30 min exposure @ 1.0 mu g/L diazinon = adverse affects exhibited up to 4.5 hrs after exposure.

Dimethoate does not photodegrade. Under anaerobic soil conditions, dimethoate does degrade, though not as rapidly as under aerobic conditions. The anaerobic half-life was found to be approximately 22 days. The major dimethoate degradate is carbon dioxide. Two non-volatile degradates, desmethyl dimethoate and dimethylthiophosphoric acid, may also result albeit at low levels (less than 2%). In dry soils, degradates (dimethylphosphoric acid and dimethylthiophosphoric acid) may persist to a much greater extent than in aerobic soils. Though it has not been detected in laboratory studies, under field conditions dimethoxon, a toxicologically significant oxygen analogue metabolite of dimethoate, was found. Dimethoxon is 75 to 100 times as potent as dimethoate in inhibiting acetylcholinesterase.

The inert Digon ingredients petroleum distillate and cyclohexanone are considered a high priority with the EPA for testing. Cyclohexanone behaves similarly to xylene in the natural environment, though its evaporation rate is slower.

5.1.3. Vectors of Exposure (Asana and Digon)

Direct effects resulting from Asana and Digon are predominately associated with contamination of waterways resulting from drift. Drift is primarily dependent on gravity, air movement, and droplet size (NebGuide website at <<http://www.ianr.unl.edu/pubs/pesticides/g1001.htm>>). Smaller droplets stay aloft longer, and the longer a droplet is suspended the greater the potential for translocation by air currents. In still air a droplet size of 100 microns (mist) takes 11 seconds to fall 10 feet. The same size droplet would travel 13.4 feet in a 1 mph wind while dropping the same height (10 feet), and 77 feet at 5 mph (NebGuide website). Application pressure, nozzle size, nozzle type, spray angle, spray volume are all factors in determining droplet size. In general, droplet sizes increase with decreasing pressure and larger nozzle sizes. An indicated droplet size (i.e., 300 microns) really represents a median diameter of all droplets. Actual droplet sizes will range from considerably smaller as well as larger than the indicated droplet size. During temperature inversions little vertical air mixing occurs and drift can translocate contaminants several miles (NebGuide website). In addition, low relative humidity and/or high temperature conditions will increase evaporation and the potential for drift. Proposed buffers, application criteria, and concurrent drift monitoring should minimize this risk. Cessation of operations criteria includes positive hits on drift cards located 60 feet from the treatment unit or any hits beyond the aeration zone.

Post-application direct effects may occur in association with rain events that may transport the chemicals to waterways, which will convey them downstream to coho salmon habitat. The adsorption potential, stability, solubility, and toxicity of a chemical determines the extent to which it will migrate and adversely effect surface waters and groundwater (Spence *et al.* 1996). The insolubility and strong adsorbing characteristics of esfenvalerate make this chemical unlikely to leach through soils and if sediment transport is precluded, transport to waterways should be minimal. However, the high toxicity and persistence of esfenvalerate means the chemical remains a significant contamination threat longer, maybe well into the fall wet season. Conversely, the solubility and weak adsorbing characteristics of dimethoate make this chemical extremely susceptible to leaching and transport by over-ground flows. Though these characteristics make containment problematic, the solubility of dimethoate means that during unsaturated soil conditions the chemical would be carried subsurface. While this raises leaching concerns, the Tyrrell soils are silty-clay loams and silty-loams of the hydrological soil group C (characterized as slow infiltration when wet, slow rate of water transmission, fine to fine-moderate particle size).

For unsaturated soil conditions, BLM presented subsurface flow information attributed to Fetter (1988). Fetter (1988) indicates subsurface flow rates of 0.28 feet per day for silty-sand soils. Tyrrell Orchard soils are less sandy and should exhibit a slower rate. Although, the cited rate does not consider slopes (gradual in Tyrrell's case), which would increase the rate marginally. Considering minimum 200-foot buffers, biodegradation, and chemical half-lives, contaminate concentrations should be insignificant by the time surface water entry occurs.

For saturated soils, BLM ran the following scenario through a Method of Characteristics version 3.2 (MOC), a U.S. Geological Survey model that is typically applied to saturated flow problems. Given:

- An application rate of 0.10 pounds of esfenvalerate per acre (proposed application rate is 0.038 lbs/acre), or an application rate of 0.41 pounds per tree of dimethoate (proposed application rate is 0.028 lbs/tree).
- That 100% of the applied chemical is sitting on the soil surface at rainfall, and that no vegetative interception occurs.
- A large field with a 500-foot slope length and a 40% slope (steeper than Tyrrell Orchard).
- Soil with 4% organic matter, and is a silty loam.
- The rain event occurs prior to any chemical degradation.
- Fully saturated soil conditions for 3 days -- this would be an unusually long and intense storm event for the Tyrrell Orchard area during spring/summer.

It is estimated that:

- 1) For esfenvalerate -- 0.8% of the applied amount was found 10 feet from the treatment edge. Esfenvalerate did not reach 20 feet according to the MOC results. This is attributed to the high adsorption rate of esfenvalerate, which makes it very immobile.
- 2) For dimethoate -- 38% of the applied amount was found 10 feet from the treatment edge, 1.6% of the applied amount was found 40 feet from the edge, and less than 1% of the applied amount was found 50 feet from the field edge. Given the scenario of intermittent hard rains over a period of a week where saturated flow was not maintained, during the periods of unsaturated flow, the dimethoate would move much more slowly. Therefore, according to the MOC model, and given the 200-foot no-spray buffer and 60-foot drift limit, dimethoate would still be located 90 feet from the nearest stream.

The potential for runoff or surface leaching (top few inches of soil profile) from treatment units was modeled by BLM using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model version 3.01. The GLEAMS model, developed by the USDA Agricultural Research Service, is a computerized mathematical model developed for field-sized areas to evaluate the movement and degradation of chemicals within the plant root zone under various crop management systems. The model has been tested and validated using a variety of data on pesticide movement.

GLEAMS has four main components: hydrology, erosion, nutrients, and pesticides (the nutrients component is for fertilizer applications only). The hydrology component subdivides the soil within the rooting zone into as many as 12 computational layers. Soils data describing porosity, water retention characteristics, and organic matter content for the site-specific soil layers are collected for model initialization. During simulation, GLEAMS computes a continuous accounting of the water balance for each layer, including percolation, evaporation, and transpiration. The erosion component accounts not only for the basic soil particle size categories (sand, silt, and clay), but also for small and large aggregates of soil particles. The program accounts for the unequal distribution of organic matter between soil fractions. The pesticide component can represent chemical deposition directly on the soil, the interception of

chemicals by foliage, and subsequent washoff. Degradation rates are allowed to differ between plant surfaces and soil, and between soil horizons. Input data required by the GLEAMS model consist of five separate files: rainfall data, temperature data, hydrology parameters, erosion parameters, and chemical parameters. Output from the GLEAMS model includes accounting of concentrations by soil layer for each chemical, and the movement of pesticide residues in percolating soil waters, surface runoff waters, and those residues sorbed to eroding soil particles on a daily basis.

GLEAMS will model the concentration of chemical that will leave a target field, in this case an orchard block, that is transported by overland flow or that is sorbed to soil particles that are transported in the flow. The estimate is based on a representative five-year precipitation record and represents the proportion of days within the five-year span during which chemical would leave the treatment unit. The assumption is that this overland flow is collected in a stream at the edge of the field. In reality, varying widths of vegetative buffers exist between the modeled finding and any stream channels within the orchard. The model is not able to predict chemical concentrations reaching streams which are separated from the target fields by buffer areas. Furthermore, any mixing, dilution, or reduction of the chemical that may result as it precedes the 3,000 feet or 5,280 feet, depending on the treatment unit, downstream to coho salmon habitat can not be modeled.

There are topographic draws within the units, but any surface flow in these draws is ephemeral and would occur only in direct response to heavy precipitation. The ephemeral draws are covered with a dense mat of grass that effectively prevents surface erosion. Any surface flow occurring in these draws will likely be negligible movement of contaminated soil off the units. Aerated perimeters, sand traps, and silt barriers have been proposed to prevent the off-site transport of any contaminated sediments and organics.

Since GLEAMS cannot model the fate of the chemical within buffer areas, BLM took a conservative approach and assumed that the concentration of esfenvalerate or dimethoate leaving the fields was the amount entering the streams at the point of coho presence. The predicted concentrations of chemicals leaving the fields may be significantly lower than predicted in the risk assessments since any benefit from the riparian buffers has not been considered. In addition, there would likely be significant settling, mixing, and dilution beyond that modeled as a result of instream transport from the stream entry point to the habitat.

BLM used the *regulatory risk criteria* presented in the EPA guidance document *Standard Evaluation Procedure - Ecological Risk Assessment* (EPA 1986) to estimate the potential for adverse effects to coho salmon in Stream 12, Douglas Creek, and Stream 8. Presumption of unacceptable risk for acute toxicity was based on an estimated exposure concentration (EEC) in exceedence of 1/20th of the LC₅₀ value, and chronic toxicity was based on an EEC greater than or equal to that concentration which elicits a chronic effect, including reproductive effects. The EEC was estimated by diluting the GLEAMS modeled runoff to the estimated water volume present where coho habitat commenced. The BLM used both sublethal concentration estimates

obtained from available literature for salmonids and lethal concentrations based on estimated LC₅₀ values to calculate the probability of unacceptable risk. For esfenvalerate, 0.0004 mu g/L was used for the sublethal concentration based on Moore and Waring (2001); and for the LC₅₀ lethal concentration, BLM used 0.3 mu g/L (Exttoxnet website at <<http://ace.orst.edu/cgi-bin/mfs/01/pips>>), except during spring fry emergence when 0.09 mu g/L was used (Curtis *et al.* 1986). For dimethoate, 1.0 mu g/L was used for the sublethal concentration based on Scholz *et al.* (2000), Waring and Moore (1997), and Moore and Waring (1996); and for the LC₅₀ lethal concentration BLM used 6.2 mg/L (Exttoxnet - <<http://ace.orst.edu/cgi-bin/mfs/01/pips/dimethoa.htm>>).

For esfenvalerate applications to the McKenzie Low unit, the GLEAMS model predicted that there was a 9.0% probability that esfenvalerate would leave the treatment unit. For coho salmon in Stream 12, the risk assessment for sublethal and lethal effects concentrations predicted a 4.1% and 2.7% probability of unacceptable risk, respectively (Table 6). While in Douglas Creek, the risk assessment for sublethal and lethal effects concentrations predicted a 1.4% and 0.8% probability, respectively (Table 6).

For esfenvalerate applications to units within the Stream 8 drainage, the GLEAMS model also predicted there was a 9.0% probability that esfenvalerate would leave the treatment units. The risk assessment for sublethal and lethal effects concentrations predicted a 4.9% and 1.9% probability of unacceptable risk, respectively (Table 6).

For dimethoate applications to the McKenzie Low unit, the GLEAMS model predicted there was a 3.4% probability that esfenvalerate would leave the treatment unit. For coho salmon in Stream 12, the risk assessment for sublethal and lethal effects concentrations predicted a 3.4% and 0% probability of unacceptable risk, respectively (Table 6). The Douglas Creek sublethal and lethal effects risk assessment had identical values (Table 6).

For dimethoate applications to units within the Stream 8 drainage, the GLEAMS model predicted that 4.0% of the time dimethoate would leave the treatment units. The risk assessment for sublethal and lethal effects concentrations predicted a 4.0% and 0% probability of unacceptable risk, respectively (Table 6).

Table 6. For esfenvalerate and dimethoate that left the treatment units, the risk assessment estimated unacceptable risk probabilities for coho salmon sublethal and lethal exposure concentrations.

Chemical	Stream	Threshold	Unacceptable Risk Probability
esfenvalerate	Stream 12	sublethal	4.05 %
		lethal	2.68 %
	Douglas Creek	sublethal	1.42 %
		lethal	0.82 %
	Stream 8	sublethal	4.87 %
		lethal	1.86 %
dimethoate	Stream 12	sublethal	3.42 %
		lethal	0.00 %
	Douglas Creek	sublethal	3.42 %
		lethal	0.00 %
	Stream 8	sublethal	4.00 %
		lethal	0.00 %

In terms of the sublethal dimethoate exposures, since the assessment was based on 24 hour precipitation data and the literature on dimethoate suggests exposures of less than 24 hours may elicit sublethal effects, BLM made the assumption that any chemical leaving the site exceeded the chronic toxicity standard. NMFS believes the same scenario is likely to be relevant for esfenvalerate, which would be mean sublethal exposures of approximately 9.0% for coho salmon in both drainages.

While the risk assessments indicate the project may alter the existing water quality, it is expected that implementation of project conservation measures as described above in *Section 2 (Proposed Action)* would greatly minimize the risk that esfenvalerate or dimethoate would reach downstream coho salmon populations in concentrations sufficient to elicit significant sublethal and less likely lethal effects. Application buffers and drift monitoring should avoid drift contamination. Vegetated buffer strips and soil aeration should maximize infiltration rates and minimize over-ground flow. The soils should contain the pesticides until biodegradation and half-living renders the chemicals impotent. The vigorous grass cover should prevent erosion. Silt fencing and sand traps should minimize off-site transport of any mobilized esfenvalerate contaminated organics. Therefore, implementation of conservation measures should adequately minimize short-term and avoid long-term adverse affects to OC coho salmon.

5.2. Effects on Critical Habitat

The NMFS designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage. The proposed treatment area would not occur within designated critical habitat for OC coho salmon, but the action area may extend into critical habitat because rain events could transport insecticides offsite and downstream.

Based on risk assessment probabilities, water quality impairment could result from upslope application of Asana or Digon. For esfenvalerate, contaminated sediment could settle in stream pools or the interstitial spaces of gravels and be a contaminant source for months. In terms of dimethoate, effects would be expected to be limited to short pulses of dimethoate in solution that would dissipate quickly. Impairment of the water quality may significantly affect aquatic invertebrates within coho salmon habitat and thereby impact their prey base. The literature suggests invertebrate reductions could persist for a period of weeks (Smith and Stratton 1986), months, or even years following exposure to insecticides (Spence *et al.* 1996). Spence *et al.* (1996) state “the greatest effect of insecticide on fish probably arises from effects on terrestrial and aquatic insects that form the salmonids’ food base.”

While risk assessment estimates indicate the project may alter the existing water quality and potentially the prey base of OC coho salmon habitat, it is expected that implementation of project conservation measures as described above in *Section 2 (Proposed Action)* would greatly minimize the risk that esfenvalerate or dimethoate would reach downstream coho salmon habitats in concentrations sufficient to elicit significant sublethal and less likely lethal effects. Application buffers and drift monitoring should avoid drift contamination. Vegetated buffer strips and soil aeration should maximize infiltration rates and minimize over-ground flow. The soils should contain the pesticides until biodegradation and half-living renders the chemicals impotent. The vigorous grass cover should prevent erosion. Silt fencing and sand traps should minimize off-site transport of any mobilized esfenvalerate contaminated organics. Therefore, implementation of conservation measures should adequately minimize short-term and avoid long-term adverse modification of critical habitat.

5.3. Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as those effects of “future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation.” Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. Therefore, these actions are not considered cumulative to the proposed action.

NMFS is not aware of any specific future non-Federal activities within the action area that would cause greater impacts to listed species than presently occurs. However, the adjacent lands are in private timber production. The use of chemical fertilizers, herbicides, or pesticides as part of normal forest practice may occur, but no specific information is known regarding their use. Furthermore, NMFS does not consider the regulations governing timber harvests on non-Federal lands within Oregon to be sufficiently protective of stream and riparian habitat values. Therefore, the possibility exists that those habitat values are at risk by future harvests on non-Federal lands within the basin.

6. CONCLUSION

6.1. Asana Application

The proposed Asana insecticide application appears to possess the potential to expose OC coho salmon to sublethal (0.004 $\mu\text{g/L}$) and lethal (0.3 and 0.09 $\mu\text{g/L}$) concentrations of esfenvalerate, may have significant detrimental impacts on prey species (aquatic invertebrates), and significant esfenvalerate concentrations could persist until the next wet season to provide a continuing source of contamination. Furthermore, NMFS recognizes that specific data are not available to provide a greater degree of certainty of the actual effects likely to result. In such cases, NMFS elects to err on the side of conservatism with regard to endangered species legislatively entrusted to their care. Therefore, NMFS believes there is more than a negligible likelihood of incidental take of OC coho salmon. Our conclusion is predicated on the finding that esfenvalerate elicits sublethal and lethal effects at extremely low concentrations and modeling indicates esfenvalerate concentrations leaving the treatment units may exceed those concentrations.

After reviewing the current status of OC coho salmon, the environmental baseline for the action areas, the effects of the proposed insecticide application and the cumulative effects, NMFS has determined that the proposed Asana insecticide application, as proposed, at the Travis Tyrrell Seed Orchard is not likely to jeopardize the continued existence of the OC coho salmon, and is not likely to destroy or adversely modify designated critical habitat. This finding is based, in part, on incorporation of conservation measures into the proposed project design, including concurrent monitoring of drift during application periods. Furthermore, NMFS expects implementation of the monitoring plan as a whole to provide better information about the potential of offsite transport of contaminants. In summary, our conclusion is based on the following considerations: (1) The proposed action will occur approximately 3,000 feet and 5,280 feet upstream of designated OC coho salmon critical habitat; (2) OC coho salmon do not occur within the treatment area; (3) 200-foot minimum no-spray buffers will be used around all perennial, intermittent, or surface waters present at the time of application; (4) wind limits and drift monitoring concurrent with insecticide application will minimize the risk of direct contamination of area waterways, including the halting of activities if drift is observed 60 feet from any treatment area; (5) precipitation forecast limits, soil aeration, silt fences, and sand traps

will minimize the risk of indirect water contamination via ground transport; (6) vigorous ground cover will minimize risk of erosion and contaminated sediment transport; (7) staging areas are located well away from water on ridgetops; (8) esfenvalerate binds strongly with soils and is not water soluble; (9) esfenvalerate is broken down by sunlight and microorganisms; (10) inert ingredients are volatile and will not be available to enter waterways; (11) no new roads or vegetation removal are proposed; and (12) existing natural riparian buffers are present to assist in the protection of downslope water quality.

6.2. Digion Application

The proposed Digion insecticide application appears likely to expose OC coho salmon to sublethal concentrations (1.0 μ g/L) of dimethoate and may have significant detrimental impacts on prey species (aquatic invertebrates). Furthermore, NMFS recognizes that specific data are not available to provide a greater degree of certainty of the actual effects likely to result. In such cases, NMFS elects to err on the side of conservatism with regard to endangered species legislatively entrusted to their care. Therefore, NMFS believes there is more than a negligible likelihood of incidental take of OC coho salmon. Our conclusion is predicated on the finding that dimethoate is water soluble and the proposed conservation measures do not preclude indirect contamination of waterways via over-ground or subsurface flows from reaching active waterways, which may have associated downstream affects on coho salmon or their habitat.

After reviewing the current status of OC coho salmon, the environmental baseline for the action areas, the effects of the proposed insecticide application and the cumulative effects, NMFS has determined that the proposed Digion insecticide application, as proposed, at the Travis Tyrrell Seed Orchard is not likely to jeopardize the continued existence of the OC coho salmon, and is not likely to destroy or adversely modify designated critical habitat. In summary, our conclusion is based on the following considerations: (1) The proposed action will occur approximately 3,000 feet and 5,280 feet upstream of designated OC coho salmon critical habitat; (2) OC coho salmon do not occur within the treatment area; (3) 200-foot minimum no-spray buffers will be used around all perennial, intermittent, or surface waters present at the time of application; (4) wind limits and drift monitoring concurrent with insecticide application will minimize the risk of direct contamination of area waterways, including the halt of activities if drift is observed 60 feet from any treatment area; (5) precipitation forecast limits and soil aeration will minimize the risk of over-ground transport of chemicals to waterways; (6) vigorous ground cover will minimize risk of erosion and contaminated sediment transport; (7) staging areas are located well away from water on ridgetops; (8) dimethoate is broken down by soil microorganisms, has a representative half-life of 20 days in soil, and will not persist; (9) no new roads or vegetation removal are proposed; (10) existing natural riparian buffers are present to assist in the protection of downslope water quality; (11) modeled risk assessments indicate no lethal concentrations are likely to result; and (12) subsurface flow modeling predicts low probability of leaching to waterways.

7. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are *discretionary* measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information.

The NMFS recommends that: (1) Every effort be made to minimize the amount of insecticide used per tree; (2) further consideration be given to the use of high-lift equipment to allow downward spraying to reduce the drift threat of overspray; (3) the wind limit for spraying be reduced to 3 miles per hour; and (4) spraying within 400 feet of any waterway be limited to periods of calm winds only.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS request notification of the implementation of any conservation recommendations.

8. REINITIATION OF CONSULTATION

This concludes formal consultation under the ESA on this action in accordance with 50 CFR 402.14(b)(1). Reinitiation of consultation is required: (1) If the amount or extent of incidental take is exceeded; (2) the action is modified in a way that causes an effect on the listed species that was not previously considered in the biological assessment and this Opinion; (3) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

9. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered species and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, and sheltering. Harass is defined by NMFS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not

intended as part of, the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the term and conditions of this Incidental Take Statement.

9.1. Amount or Extent of Take

NMFS anticipates that the proposed action covered by this Opinion has more than a negligible likelihood of incidental take of juvenile OC coho salmon resulting in sublethal behavior modifications, and to a lesser degree, lethal exposure to esfenvalerate or dimethoate. Effects of actions such as these are largely unquantifiable in the short term. The effects of these activities on population levels are also largely unquantifiable and not expected to be measurable in the long term.

Therefore, even though NMFS expects some low level of incidental take may occur due to the action covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take to the species itself. In instances such as this, NMFS designates the expected level of take in terms of the extent of take allowed. Therefore, NMFS limits the area of allowable incidental take to all reaches of Stream 12, that portion of Douglas Creek between Stream 12 and the Siuslaw River, all reaches of Stream 8, and all tributaries of Stream 8 for a period of six months following application. Incidental take occurring beyond these areas (i.e., Siuslaw River) or time limit is not authorized by this consultation. Based on the information provided, NMFS anticipates that an unquantifiable but low level of incidental take could occur as a result of the action covered by this Opinion. Moreover, the small amount of take that may occur is expected to be non-lethal.

9.2. Reasonable and Prudent Measures

NMFS believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of OC coho salmon. Minimizing the amount and extent of take is essential to avoid jeopardy to the listed species.

1. Minimize the likelihood of incidental take associated with insecticide application by implementing conservation measures.
2. Minimize the likelihood of incidental take by confirming that esfenvalerate nor dimethoate are detectable beyond the areas authorized by this consultation.
3. Monitor the effectiveness of the proposed conservation measures in minimizing incidental take and report to NMFS.

9.3. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, BLM must comply with the

following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To Implement Reasonable and Prudent Measure #1, above, the BLM shall:

- a. Implement all conservation measures described in the Proposed Action section of this Opinion, or gain prior authorization from NMFS to forgo implementation of any measure.
- b. Review the provisions of this Opinion with the contracted applicator prior to commencing insecticide application operations.
- c. Review Tyrrell Orchard's spill response plan with the contracted applicator prior to commencing insecticide application operations.
- d. Notify NMFS (R. Markle, 503-230-5419) one week prior to commencing the initial insecticide application.
- e. Allow NMFS to be present, at its discretion, during any insecticide application operation.
- f. Ensure all chemical storage, chemical mixing, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any riparian area, perennial or intermittent waterway, unprotected ephemeral waterway, or wetland.
- g. Halt all application operations whenever drift has been observed to exceed 59 feet from the treatment area (either visually observed or indicated by drift card hits at 60 feet).
- h. Not recommence insecticide application following a drift instigated work stoppage until NMFS (R. Markle, 503-230-5419) has been notified, and environmental conditions and/or application technique have been sufficiently altered to prevent 60-foot drift.
- i. Not conduct insecticide application when precipitation is forecast to occur within 24 hours.
- j. Apply a 200-foot no-spray buffer on any roadside ditches that may convey contaminants to waterways.

2. To implement Reasonable and Prudent Measure #2, above, the BLM shall:

- a. Monitor the boundaries of the designated incidental take areas by implementing those pertinent actions detailed in the Effectiveness Monitoring section of the Water Quality Monitoring Plan (Appendix A).

3. To implement Reasonable and Prudent Measure #3, above, the BLM shall:

- a. Implement the Water Quality Monitoring Plan as presented to NMFS during consultation (Appendix A).
- b. Following insecticide application, sample the first over-ground flow leaving the treatment units.
- c. Continue monitoring runoff for a minimum of six months following insecticide application (the period identified by BLM as having the highest probability of aquatic resource contamination due to runoff).
- d. Notify NMFS (R. Markle, 503-230-5419) of any significant deviation from the Water Quality Monitoring Plan (Appendix A).
- e. Following the completion of insecticide application and monitoring, provide NMFS with a summary report by December 31, 2001, describing the success of conservation measures required under Reasonable and Prudent Measure #1, and the results of monitoring under Reasonable and Prudent Measure #2 and #3(a). The report should focus on actions taken to ensure that esfenvalerate or dimethoate was contained to the treatment area to the greatest extent possible. It is recommended that the report include photo documentation.
- f. Monitoring reports shall be submitted to:

National Marine Fisheries Service
Attn: Robert Markle
525 NE Oregon Street, #500
Portland, Oregon 97232-2778

Reference: OSB2001-0029

- g. If a dead, sick or injured Oregon Coast coho salmon is located, immediate notification must be made to Rob Markle, NMFS, telephone: (503-230-5419), or NMFS Law Enforcement, (360-418-4246). Care will be taken in handling sick or injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured species or preservation of biological material from a dead animal, the finder has the responsibility to carry out instruction provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

10. ESSENTIAL FISH HABITAT CONSULTATION

10.1 Background

In addition to ESA consultation, BLM requested consultation on the proposed insecticide application for Essential Fish Habitat (EFH) under the Magnuson-Stevens Act. The objective of the EFH consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse impacts to EFH resulting from the proposed action. BLM determined the proposed action would not adversely affect EFH for Pacific salmon (coho salmon and chinook salmon).

10.2. Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NMFS on activities that may adversely affect EFH.

EFH means “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (MSA §3). The Pacific Fisheries Management Council (Council) has designated EFH for federally-managed groundfish (PFMC 1998a), coastal pelagic (PFMC 1998b), and Pacific salmon (PFMC 1999) fisheries.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NMFS is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

The consultation requirements of section 305(b) of the MSA (16 U.S.C. 1855(b)) provide that:

- Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;
- NMFS shall provide conservation recommendations for any Federal or State activity that may adversely affect EFH;
- Federal agencies shall, within 30 days after receiving conservation recommendations from NMFS, provide a detailed response in writing to NMFS regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NMFS, the Federal agency shall explain its reasons for not following the recommendations no less than 10 days

prior to granting final authorization for the subject action.

10.3. Identification of Essential Fish Habitat

Groundfish and coastal pelagic EFH extend from tidal submerged environments within Washington, Oregon, and California offshore to the exclusive economic zone limit (200 miles) (PFMC 1998a; PFMC 1998b). A description and identification of EFH for salmon is found in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). The EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to chinook salmon and coho salmon in Washington, Oregon, Idaho, and California, except above the impassable barriers identified by the Council (PFMC 1999). Chief Joseph Dam, Dworshak Dam, and the Hells Canyon Complex (Hells Canyon, Oxbow, and Brownlee Dams) are among the listed man-made barriers that represent the upstream extent of the Pacific salmon fishery EFH. Salmon EFH excludes areas upstream of longstanding naturally impassable barriers (i.e., natural waterfalls in existence for several hundred years). In the estuarine and marine areas, proposed designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (200 miles) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

10.4. Proposed Actions

The proposed action is detailed above in *Section 2*. The action area encompasses the area immediately associated with the subject insecticide application at Tyrrell Orchard, as well as points downstream that may experience chemical contamination.

10.5. Effects of the Proposed Action

NMFS concludes that the effects of this project on designated EFH are likely to be within the range of effects considered in the Endangered Species Act portion of this consultation, and finds that the proposed insecticide application may adversely affect EFH designated for Pacific salmon (coho salmon and chinook salmon).

10.6. Conclusion

NMFS believes that the proposed action may adversely affect designated EFH for the Pacific salmon (coho salmon and chinook salmon).

10.7. EFH Conservation Recommendations

The Conservation Recommendations presented above in *Section 7*, and the Reasonable and Prudent Measures and corresponding Terms and Conditions outlined above in *Section 9* are applicable to designated Pacific salmon EFH. Therefore, NMFS recommends that they be

adopted as EFH conservation measures. Should BLM adopt and implement these recommendations, potential adverse impacts to EFH would be minimized.

10.8. Statutory Requirements

Please note that the Magnuson-Stevens Act (§305(b)) requires the Federal agency to provide a written response to NMFS' EFH conservation recommendations within 30 days of its receipt of this letter and 10 days prior to final authorization of the proposed action. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with NMFS' conservation recommendations, the reasons for not implementing them must be included.

10.9. Consultation Renewal

BLM must reinitiate EFH consultation with NMFS if the action is substantially revised in a way that may adversely affect EFH or new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600.920).

11. LITERATURE CITED

- Beauvais, S.L., S.B. Jones, S.K. Brewer, and E.E. Little. 2000. Physiological measures of neurotoxicity of diazinon and malathion to larval rainbow trout (*Oncorhynchus mykiss*) and their correlations with behavioral measures. *Environmental Toxicology and Chemistry*, vol. 19, no. 7, pp. 1875-1880.
- BLM (Bureau of Land Management). 1995. Record of Decision and Resource Management Plan. Eugene District, Eugene, Oregon.
- Brewer, S.K., E.E. Little, A.J. DeLonay, S.L. Beauvais, S.B. Jones, and M.R. Ellersieck. 2001. Behavioral dysfunction correlate to altered physiology in rainbow trout (*Oncorhynchus mykiss*) exposed to cholinesterase-inhibiting chemicals. *Archives of Environmental Contamination and Toxicology* 40:70-76.
- Chapman, R.A., C.M. Tu, C.R. Harris, and C. Cole. 1981. Persistence of Five Pyrethroid Insecticides in Sterile and Natural, Mineral and Organic Soil. *Bull. Environm. Contam. Toxicol.* 26:513-519.
- Coats, J.R., and N.L. O'Donnell-Jeffrey. 1979. Toxicity of four synthetic pyrethroid insecticides to rainbow trout. *Bull. Environ. Sci. Health* B16:605-615.
- Curtis, L.R., W.K. Seim, and G.A. Chapman. 1985. Toxicity of Fenvalerate to Developing Steelhead Trout Following Continuous or Intermittent Exposure. *Journal of Toxicology and Environmental Health* 15:415-457.
- Eisler, R. 1992. Fenvalerate hazards to fish, wildlife, and invertbrates: A synoptic review. Contaminant Hazard Reviews Report 24, U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708. pp 43.
- Fetter, C.W. 1988. *Applied Hydrogeology*, 2nd Edition. MacMillan Publishing Company, New York, pp 592.
- Heinis, L.J., and M.L. Knuth. 1992. The mixing, distribution and persistence of esfenvalerate within littoral enclosures. *Environmental Toxicology and Chemistry*, vol 11, no. 1, pp. 11-25.
- Holcombe, G.W., G.L. Phipps, and D.K. Tanner. 1982. The acute toxicity of kethane, dursban, disulfoton, pydrin, and permethrin to fathead minnows *Pimephales promelas* and rainbow trout *Salmo gairdneri*. *Environ. Pollut.* A29:167-178.
- Little, E.E., R.D. Archeski, B.A. Flerov, and V.I. Koslovskaya. 1990. Behavioral indicators of sublethal toxicity in rainbow trout. *Archives of Environmental Contamination and*

Toxicology 19:380-385.

- Little, E.E., F.J. Dwyer, J.F. Fairchild, A.J. DeLonay, and J.L. Zajicek. 1993. Survival of bluegill and their behavioral responses during continuous and pulsed exposures to esfenvalerate, a pyrethroid insecticide. *Environmental Toxicology and Chemistry*, vol. 12, no. 5, pp. 871-878.
- Mauk, W.L., L.E. Olson, and L.L. Marking. 1976. Toxicity of natural pyrethrins and five pyrethroids to fish. *Arch. Environ. Contam. Toxicol.* 4:18-29.
- McLeese, D.W., C.D. Metcalfe, and V. Zitko. 1980. Lethality of permethrin, cypermethrin, and fenvalerate to salmon, lobster and shrimp. *Bull. Environ. Contam. Toxicol.* 4:18-29.
- Moore, A.W. and C.P. Waring 1996. Sublethal effects of the pesticide Diazinon on olfactory function in mature male Atlantic salmon parr. *Journal of Fish Biology* 48:758-775.
- Moore, A.W. and C.P. Waring 2001. The effects of a synthetic pyrethroid pesticide on some aspects of reproduction in Atlantic salmon (*Salmo salar* L.). *Aquatic Toxicology* 52:1-12.
- Mulla, M.S., H.A. Navvab-Gjrati, and H.A. Darwazeh. 1978. Toxicity of mosquito larvicidal pyrethroids to four species of freshwater fishes. *Environ. Entomol.* 7:428-430.
- NMFS (National Marine Fisheries Service). 1996. Making Endangered Species Act Determinations of Effect for Individual or Groups Actions at the Watershed Scale. NMFS Environmental and Technical Services Division, Portland, Oregon. August, 1996. 22p. plus appendices.
- Scholz, N.L., N.K. Truelove, B.L. French, B.A. Berejikian, T.P. Quinn, E. Casillas, and T.K. Collier. 2000. Diazinon disrupts antipredator and homing behaviors in chinook salmon (*Oncorhynchus tshawytscha*). *Can. J. Fish. Aquat. Sci.* 57: 1911-1918.
- Smith, T.M. and G.W. Stratton. 1986. Effects of synthetic pyrethroid insecticides on nontarget organisms. *Residue Reviews*, vol. 97, pp. 93-120.
- Spence, B.C., G.A. Lomnický, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. (Available from the National Marine Fisheries Service, Portland, Oregon). 356 p.
- Tanner, D.K., and M.L. Knuth. 1996. Effects of esfenvalerate on the reproductive success of the bluegill sunfish, *Lepomis macrochirus* in littoral enclosures. *Archives of Environmental Contamination and Toxicology*, vol. 31, no. 2, pp. 244-251.

United States Environmental Protection Agency (EPA). 1986. Hazard Evaluation Division, Standard Evaluation Procedure - Ecological Risk Assessment. Prepared by D.J. Urban and N.J. Cook. EPA, Office of Pesticide Programs, Washington, D.C.

USFS/BLM (United States Forest Service/Bureau of Land Management). 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Forest Service/Bureau of Land Management. April 1994.

Waring, C.P. and A. Moore. 1997. Sublethal effects of a carbamate pesticide on pheromonal mediated endocrine function in mature male Atlantic salmon (*Salmo salar* L.) parr. Fish Physiology and Biochemistry 17:203-211.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

Worthing, C.R., S.B. Walker. 1983. The pesticide manual, 7th edition. Croydon, The British Crop Protection Council. pp. 695.

12. APPENDIX A

Water Quality Monitoring Plan (Draft) Tyrrell Seed Orchard

Goal

The goal of this plan is to determine if implementation of the 2001 Tyrrell Seed Orchard spray plan results in the short term presence of esfenvalerate or dimethoate in streams due to drift, the presence of esfenvalerate due to runoff, or the presence of dimethoate due to subsurface flow. This goal includes quantifying the concentrations in both water and sediment to validate impacts predicted by the GLEAMS model and the associated assumptions. The data will be utilized in discussing effects and further long term monitoring in the future EIS.

Background

Agencies and the public are concerned that pesticide application in the Tyrrell Seed Orchard may be harmful to fish, resulting in stream concentrations which exceed those known to have effects on aquatic life. Mitigation measures required by the 2001 Travis Tyrrell Seed Orchard Insect Control EA (EA) will minimize the potential affects to water quality from spills, drift, or runoff. The water quality monitoring required by this plan is focused on pesticide drift, and surface or subsurface runoff, where appropriate, from the proposed application fields. Pesticide spill and the associated monitoring is outlined in the Pesticide Safety Plan.

This plan covers compliance, effectiveness, and validation monitoring. The compliance monitoring is intended to document the design features and mitigation measures which are actually implemented. The effectiveness component documents how well the design features performed in avoiding introduction of esfenvalerate or dimethoate to the aquatic system. The effectiveness data will also be used to validate that the water quality modeling conducted for the EA was conservative.

Specific Objectives

- 1) Does drift of ground application occur? Monitor all chemical applications to ensure compliance with mitigation measures and to document application rates, environmental conditions and the actual occurrence of drift.
- 2) Does aerial ground of esfenvalerate or dimethoate result in measureable concentrations in the streams associated with the applied fields? Conduct effectiveness monitoring for esfenvalerate and dimethoate applications to ensure that mitigation measures were effective in preventing drift, runoff, and/or subsurface flow from entering surface water.
- 3) What are the measured esfenvalerate or dimethoate concentrations from runoff water an/or sediment in comparison to those predicted in the impact assessment? Conduct validation monitoring to document the esfenvalerate concentrations in runoff water and sediment and compare to predicted concentrations in relation to literature standards (LC₅₀ for trout and embryos).

Compliance Monitoring

All chemical applications will be observed and documented by the Orchard Manager or designated representative. Items to be documented include: type of pesticide applied, date of application, method of application, area treated, amount applied, precipitation for the 3 days preceding and following application, location used for mixing and loading, wind direction and speed, relative humidity, air temperature, and notes regarding whether any leakage or spills occurred. A list of all implemented design features for each unit applied will be included in report form and provided for the Annual Implementation and

Monitoring Summary. An existing climate station at the orchard facility will provide a record of compliance documentation and basic information to predict runoff patterns for effectiveness and validation monitoring.

Effectiveness Monitoring

Drift Cards

All Orchard Units planned for aerial spray will have spray cards placed along sensitive treatment unit boundaries such that drift from the application can be captured and characterized. In those areas, spray cards would be placed in a staggered manner 35 -100 feet outside the perimeter of the spray unit and be spaced 100 feet apart depending on the sensitivity of the area. Immediately after the application, the cards will be collected and reviewed to determine if any drift has occurred, the extent of the drift, and the potential for contamination of the adjacent waterbodies. A copy of all the cards will be kept on file at the Tyrrell Seed Orchard along with a record of their location and all the compliance monitoring documentation.

Water Samples for Drift Introduction

If spray cards adjacent to a flowing water body indicate that drift exceeded the distance of the spray cards, then water samples would be collected. The streams closest to the application areas contain the highest risk of drift transport.

Samples will be taken within 24 hours prior to application in the event that post-application monitoring is required due to a violation of the drift perimeter. If the drift cards indicate that drift has extended past the cards located furthest from the application area, it will be assumed that there is the potential for drift to enter the waterway and samples will be collected at 15 minutes, 2 hours, 4 hours, 8 hours and 24 hours after the first swath has been sprayed near the buffer strip (as per ODF, 1994). The samples will be collected at a predefined points along flowing streams immediately adjacent to the spray units (appendix 1).

The time of collection will be based on the travel time of water movement in the flowing channels associated with the treatment areas. The calculation for travel time is provided in appendix 2. Flow velocity measurements will be taken during the 24 hours prior to application in order to calculate travel time.

During the 24 hours after application, a series of composite samples would be collected at Stream 8 (highest risk) through the use of a continuous pumping sampler(if possible). This data will provide a 24hour concentration to compare with the water quality criteria and the more expensive ODF protocol. If the pumping sampler provides comparable results, the cost of future long term monitoring could be reduced and the efficiency in collecting storm samples improved.

All data will be used in conjunction with the spray cards to illustrate the effectiveness of mitigating potential drift introduction. Samples will be analyzed at a State certified laboratory that has detection limits of ppb for esfenvalerate and ppm for dimethoate. Samples will be collected in accordance with laboratory instructions (see appendix 3). When sites are visited, a water sample will also be collected and analyzed for pH, specific conductance, and turbidity to provide additional interpretive data.

Water and Sediment Sampling for Runoff Introduction

Due to the different chemical characteristics of esfenvalerate and dimethoate, they will be treated separately in the effectiveness monitoring section.

1) Esfenvalerate

In terms of the EA GLEAMS modeling results, potential runoff events which occur within the first 6 months after spray application have the highest probability for carrying concentrations which could impact aquatic life. One study (Rashin and Graver, 1993) determined that runoff events within the first 72 hours of application were the most important in terms of increases in detectable concentrations in ppb. This monitoring plan will target those periods of precipitation which result in field surface runoff and increased stream flow which are most likely to carry the greatest concentrations. The effectiveness of design features such as increased aeration, wide untreated buffer strips and erosion control will be assessed through monitoring field runoff/field sediment and streamflow concentrations.

Field runoff samples of both water and sediment will be captured at the edge of field in the McKenzie Low, Wells Creek, Lorane, Noti and Swiss Home orchard units (see map B). These units will have a collection chamber installed at the low point of the downslope edge of the field. This is intended to provide a collection point for access to surface runoff and sediment from the orchard unit. During rainfall events which exceed .5 inches per hour (to be refined on a per unit basis), these sites will be visited and a sub-sampled taken from the collection chamber. A representative sample of the contained sediments will also be taken. Both samples will be shipped to the lab and completed within 7 days. Once the first runoff event is captured and results become available, further sampling will be determined as needed. Since streams are not in close proximity to these units and hydrologic association is questionable, edge of field sampling presents the best opportunity to collect any measurable concentrations lost from the unit. During the stormflow event, streams nearest to these locations will be assessed for connectivity. If connection is apparent, samples will be taken in the associated stream.

Sampling of water and sediment will occur in Stream 8 due to the channel connectivity to the Wells Cr., Swiss Home, Noti, and Lorane spray units, and the ability to achieve a representative sample from a continuous pumping sampler. This station will collect water and sediment samples on either a flow weighted or time weighted basis with the intention of providing concentrations for multiple runoff events over time. Only samples which are taken during overland flow events will be analyzed at the lab. For more information on the Stream 8 station refer to the validation monitoring section. Comparisons will be made between edge of field concentrations and instream concentrations.

All data will be used in conjunction with on- site climate data to illustrate the effectiveness of design features in minimizing introduction of esfenvalerate to the aquatic system. Samples will be analyzed at a State certified laboratory that has detection limits of ppb for esfenvalerate. Samples will be collected in accordance with laboratory instructions. When sites are visited, a water sample will also be collected and analyzed for pH, specific conductance, and turbidity to provide additional interpretive data.

2) Dimethoate

In terms of the EA GLEAMS modeling results, potential runoff events which occur within the first 6 months after spray application have the highest probability for carrying concentrations which could impact aquatic life. Dimethoate has the highest potential to move off the fields via saturated groundwater flow. However, surface flow is a possibility. This monitoring plan will target those periods of precipitation which result in 1) field surface runoff, 2) subsurface field runoff and 2) subsurface transport to stream which are most likely to carry the greatest concentrations. The effectiveness of design features such as increased aeration, wide untreated buffer strips and erosion control will be assessed through monitoring field runoff/field sediment and streamflow concentrations.

Surface and subsurface samples field runoff water will be captured at the edge of field in the McKenzie Low, Wells Creek, Lorane, Noti, and Swiss Home orchard units. These units will have a collection chamber installed at the low point of the downslope edge of the field. This is intended to provide a collection point for access to surface runoff and subsurface runoff from the orchard unit. During rainfall events which exceed .5 inches per hour (to be refined on a per unit basis) these sites will be visited and a sub-sample taken from the collection chambers. A representative sample of the contained sediments

will also be taken. Samples will be shipped to the lab and completed within 7 days. Once the first runoff event is captured and results become available, further sampling will be determined as needed. Since streams are not in close proximity to these units and hydrologic association is questionable, edge of field sampling presents the best opportunity to collect any measurable concentrations lost from the unit. During the stormflow event, streams nearest to these locations will be assessed for connectivity. If connection is apparent, samples will be taken in the associated stream.

Sampling of water and sediment will occur in Stream 8 due to the channel connectivity to the Wells Cr., Noti, Swiss Home, and Lorane spray units, and the ability to achieve a representative sample from a continuous pumping sampler. This station will collect water and sediment samples on either a flow weighted or time weighted basis with the intention of providing concentrations for multiple runoff events over time. Only samples which are taken during or relative to overland flow events (a travel time will need to be determined and the actual sampling may occur after the overland flow event) will be analyzed at the lab. For more information on the Stream 8 station refer to the validation monitoring section. Comparisons will be made between edge of field concentrations and instream concentrations.

All data will be used in conjunction with on-site climate data to illustrate the effectiveness of design features in minimizing introduction of dimethoate to the aquatic system. Samples will be analyzed at a State certified laboratory that has detection limits of ppb for dimethoate. Samples will be collected in accordance with laboratory instructions. When sites are visited, a water sample will also be collected and analyzed for pH, specific conductance, and turbidity to provide additional interpretive data.

Validation Monitoring

Validation monitoring is intended to verify the water quality modeling predictions disclosed in the Impact Assessment.

This monitoring component will apply the two basic data sets gathered in the effectiveness monitoring. It is intended to be conducted over the long term and in conjunction with future monitoring and analysis associated with the Tyrrell Integrated Pest Management EIS. The first set is characterizing the runoff and sediment actually leaving the orchard units and the second set is reflecting the instream concentrations in the high risk area associated with stream channel 8.

A continuous recording streamflow station will be installed on Stream 8. This will allow for either a flow activated sample to be taken or for a composite sample to be correlated with flow during the most likely periods in which concentrations could be detected. Following the spray application in April (if possible) a composite sample will be taken over each period of increase flows (before summer 2001) in order to characterize the concentration over the 24 hour period during a runoff event. The climate record collected at the orchard for that period will be used to model a predicted edge of field concentration using the GLEAMS model. These concentrations will be diluted by the continuous flow data from the station. The resulting concentrations will be compared with the actual measured concentrations.

A staff gauge will be installed in stream 8 at the sample point and referenced to a permanent local bench mark and the streamflow gauge. Discharge measurements will be taken during stormflow and sampling events. A discharge rating curve will be developed to allow estimates of discharge from staff gauge readings and stage measurements at the streamgauge. The instantaneous streamflow discharge measurements taken during initial drift sampling will also be used as calibration points for the discharge rating curve. Note, the limitation to accomplishing the validation monitoring applies only the potential spring runoff period since there are several equipment logistics to resolve. Validation monitoring would be in place in time for the fall runoff period.

All efforts will be made to perform validation monitoring during the spring runoff.

Data Collection and Analysis Discussion

The overall hypothesis being tested is that implementation of EA design features will result in concentrations of esfenvalerate or dimethoate in streamflow, field runoff, and/or sediment below those associated with impacts to the most sensitive beneficial uses (e.g. salmonid embryos).

In order to test this hypothesis in terms of drift we must have accurate data on climatic factors and design features that are actually implemented. Introduction of esfenvalerate or dimethoate from drift is the most likely immediate transport route to the aquatic system. Using the evidence from drift cards placed in the vicinity of the nearest streams along with data from wind speed and direction compared to the post 24 hour streamflow concentrations, we should be able to show direct linkage between the application and actual exposure concentrations from drift.

In order to test this hypothesis in terms of runoff we must have accurate data on climatic factors, runoff characteristics and design features that are actually implemented. Introduction of esfenvalerate or dimethoate concentrations from runoff is most likely to occur in the spring and early summer following application. These would be associated with intense precipitation events. Through the use of rainfall data collected at the orchard we can estimate the potential runoff events.

During the first runoff event resulting in overland flow, we would sample runoff and sediment from fields with no associated streams (low risk). These data would be compared to existing estimates of field loss in the spray EA along with refined modeling using the measured climatic data. Comparison would be made with literature values for effects to salmonid embryos. The need for further sampling of additional field runoff will be reviewed after the results from the first major runoff event. The monitoring plan will be revised as to the need for future monitoring.

In the moderate risk areas associated with stream 8, realtime streamflow data will be collected in order to sample during periods when the stream is most likely to contain concentrations of esfenvalerate from the associated fields. Concentrations derived from instream samples will be related to stormflow volume over time in order to attain an average concentration over a 24 hour period. These data would be compared to existing estimates of stream concentrations in the EA along with refined modeling using the measured climatic data. Comparison would be made between edge of field concentrations and stream concentrations in order to show potential reductions in concentrations due to attenuation in buffers. Comparison would be made with literature values for effects to salmonid embryos. Results from partitioned samples will help to target future sampling. The need for further sampling of additional stormflow will be reviewed after the results from the first major runoff event. The monitoring plan will be revised as to the need for future monitoring. The effectiveness of design features such as increased aeration, wide untreated buffer strips and erosion control will be assessed through comparing the concentrations from field runoff and field sediment to those that actually measured in the stream.

Data Reporting Discussion:

The data collected will be compiled, analyzed and contained in an Annual IPM Monitoring Report which will be available at the Eugene District and the Travis Tyrrell Seed Orchard. A summary of the results will be presented in the Annual Program Summary for the Eugene District. Results from compliance monitoring will also be included in the Eugene District Annual Implementation Monitoring Report.

References:

Oregon Department of Forestry: Forest Chemical Application Monitoring Program, November 1997

Rashin, E.;C. Graber. 1993 Effectiveness of best management practices for aerial application of forest pesticides. TFW - WQ1 - 93-001

Appendix 1: Stream Adjacent to Application Areas

In the event that drift extends beyond the drift card locations, water samples will be collected from the stream adjacent to the positive drift cards listed for each application area if they contain flowing water.

McKenzie Low - Stream 19 and/or Stream 12

Wells Cr. - Stream 9

Swiss Home - Stream 51

Lorane - Stream 54 and/or Stream 8

Noti - Stream 8

Appendix 2: Calculation of Travel Time

The travel time is calculated as follows:

$$\frac{L}{v} + 15 \text{ minutes} = 15 \text{ minute sample time}$$

60 seconds

L = length of stream between the top of treatment unit and the sample point plus the length of stream between bottom of treatment unit and sample point divided by 2 (ft)

v = average velocity of stream (ft/sec)

Appendix 3: Laboratory collection, storage, and transport instructions

TBA

velocity will be measured with a velocity meter when the control sample is collected